CLAIM AMENDMENTS

Claim 1 (previously presented): A method for raising a spacecraft launched into a transfer orbit about the Earth from the transfer orbit to a geosynchronous orbit, comprising the steps of:

launching a spacecraft having chemical and electric propulsion thrusters and a solar array;

firing the chemical propulsion thrusters at apogees of intermediate orbits, starting from the transfer orbit initiated by the launch vehicle, to successively raise perigees of the orbit until the spacecraft perigee substantially clears the Van Allen radiation belts, and where the semi-major axis of the intermediate orbit is substantially less than the semi-major axis of a final orbit, and where the inclination of the intermediate orbit is substantially greater than the inclination of the final orbit;

firing the electric propulsion thrusters to raise the orbit of the spacecraft from the orbit achieved by the chemical propulsion thrusters firing step to near geosynchronous orbit by steering the thrust vector both in-plane and out-of-plane while rotating the spacecraft body and steering the solar array to maintain the sun's illumination on the solar array; and

firing selected ones of the chemical and electric propulsion thrusters to achieve final geosynchronous orbit.

Claim 2 (original): The method recited in Claim 1 wherein the thrust vector is substantially normal to the axis of the solar array and the sun is maintained substantially normal to the solar array.

Claim 3 (canceled)

Claim 4 (original): The method recited in Claim 1 wherein the transfer orbit is a subsynchronous orbit.

Claim 5 (original): The method recited in Claim 1 wherein the transfer orbit is a supersynchronous orbit.

Claim 6 (original): The method recited in Claim 1 wherein a thruster firing profile for firing the thrusters is generated onboard the spacecraft.

Claim 7 (original): The method recited in Claim 1 wherein a thruster firing profile for firing the thrusters is generated on the Earth 13 and uplinked to the spacecraft.

Claim 8 (original): The method recited in Claim 1 wherein a spacecraft steering profile is generated on the Earth that steers the thrust vector (ΔV) to maintain the illumination of the sun's rays substantially normal to solar array.

Claim 9 (canceled)

Claim 10 (original): The method recited in Claim 1 wherein a spacecraft steering profile is generated onboard the spacecraft that steers the thrust vector (ΔV) to maintain the illumination of the sun's rays substantially normal to solar array.

Claim 11 (original): The method recited in Claim 1 wherein the step of firing the electric propulsion thrusters to raise the orbit of the spacecraft is periodically revised to compensate for disturbances experienced by the spacecraft.

Claim 12 (original): The method recited in Claim 1 wherein the step of firing the electric propulsion thrusters to raise the orbit of the spacecraft is completed prior to reaching a desired on-orbit location whereupon chemical propulsion thruster firings are used to guide the spacecraft to the final desired orbit position to compensate for disturbances experienced by the spacecraft.

Claim 13 (original): The method recited in Claim 1 wherein the step of firing the electric propulsion thrusters to raise the orbit of the spacecraft is completed upon reaching a desired on-orbit location and chemical propulsion thruster firings are interspersed with electric thruster operation to guide the spacecraft to the final desired orbit position to compensate for disturbances experienced by the spacecraft.

Claim 14 (original): The method recited in Claim 1 wherein the step of firing the electric propulsion thrusters to raise the orbit of the spacecraft includes operating the electric thrusters in a throttled-back mode to enable increased acceleration capability to cope with disturbances experienced by the spacecraft.

Claim 15 (original): The method recited in Claim 1 wherein the step of firing the electric propulsion thrusters to raise the orbit of the spacecraft comprises initially turning off one or more of a plurality of electric thrusters turned off so they can be turned on at a later time to give increased acceleration capability in the presence of disturbances experienced by the spacecraft.

Claim 16 (original): The method recited in Claim 1 wherein the step of firing the electric propulsion thrusters to raise the orbit of the spacecraft comprises pre-planned electric thruster coast periods that are selectively shortened or lengthened in duration to compensate for disturbances experienced by the spacecraft.

Claim 17 (original): The method recited in Claim 1 wherein the step of firing the electric propulsion thrusters to raise the orbit of the spacecraft comprises adjusting attitude steering profiles using a plurality of momentum wheels.

Claim 18 (original): The method recited in Claim 1 wherein the step of firing the electric propulsion thrusters to raise the orbit of the spacecraft comprises pointing the resultant thrust vector away from the center of mass of the spacecraft.

Claim 19 (original): The method recited in Claim 18 wherein gimbals are used to point the thrusters away from the center of mass of the spacecraft to provide control torque.

Claim 20 (original): The method recited in Claim 18 wherein one or more thrusters are differentially throttled to point the resultant thrust away from the center of mass of the spacecraft to provide control torque.

Claim 21 (original): The method recited in Claim 18 wherein one thruster on either the North or South side of the spacecraft is used to increase the effective thrust and decrease the duration of the electric orbit raising phase to raise the spacecraft from the orbit achieved by the chemical propulsion thrusters firing step to near geosynchronous orbit.

Claim 22 (previously presented): The method recited in Claim 18 wherein at least two adjacent thrusters on either the North or South side of the spacecraft are used to increase the effective thrust and decrease the duration of the electric orbit raising phase to raise the spacecraft from the orbit achieved by the chemical propulsion thrusters firing step to near geosynchronous orbit.

Claim 23 (previously presented): A system for raising a spacecraft launched into a transfer orbit about the Earth from the transfer orbit to a geosynchronous orbit, comprising:

a spacecraft comprising chemical and electric propulsion thrusters and a solar array;

a processor onboard the spacecraft for:

firing the chemical propulsion thrusters at apogees of intermediate orbits, starting from the transfer orbit initiated by the launch vehicle, to successively raise perigees of the orbit until the spacecraft perigee substantially clears the Van Allen radiation belts, and where the semi-major axis of the intermediate orbit is substantially less than the semi-major axis of a final orbit, and where the inclination of the intermediate orbit is substantially greater than the inclination of the final orbit;

firing the electric propulsion thrusters to raise the orbit of the spacecraft from the orbit achieved by the chemical propulsion thrusters firing step to near geosynchronous orbit by steering the thrust vector both in-plane and out-of-plane while rotating the spacecraft body and steering the solar array to maintain the sun's illumination on the solar array; and

firing selected ones of the chemical and electric propulsion thrusters to achieve final geosynchronous orbit.

Claim 24 (original): The system recited in Claim 23 wherein the spacecraft comprises a processor that generates a thruster firing profile for firing the thrusters that is generated onboard the spacecraft.

Claim 25 (original): The system recited in Claim 24 wherein the processor generates a spacecraft steering profile onboard the spacecraft that steers a thrust vector (ΔV) to maintain the illumination of the sun's rays substantially normal to solar arrays of the spacecraft.

Claim 26 (canceled)

Claim 27 (original): The system recited in Claim 23 further comprising:

ground apparatus including a processor that determines a thruster firing profile for firing the thrusters and generates thruster firing commands that implement the thruster firing profile, and communication apparatus that uplinks commands to the spacecraft.

Claim 28 (original): The system recited in Claim 27 wherein the processor in the ground apparatus determines a spacecraft steering profile for steering the thrust vector to maintain the illumination of the sun's rays substantially normal to solar array and generates spacecraft steering commands that implement the spacecraft steering profile, and wherein the communication apparatus uplinks spacecraft steering commands to the spacecraft.

Claim 29 (canceled)

Claim 30 (new): A method for raising a spacecraft launched into a transfer orbit about the Earth from the transfer orbit to a geosynchronous orbit, comprising the steps of:

launching a spacecraft having chemical and electric propulsion thrusters and a solar array;

firing the chemical propulsion thrusters at apogees of intermediate orbits, starting from the transfer orbit initiated by the launch vehicle, to successively raise perigees of the orbit until the spacecraft perigee substantially clears the Van Allen radiation belts, and where the semi-major axis of the intermediate orbits is substantially less than the semi-major axis of a final orbit, and where the inclination of the intermediate orbits is substantially greater than the inclination of the final orbit;

firing the electric propulsion thrusters to raise the orbit of the spacecraft from the orbit achieved by the chemical propulsion thrusters firing step to near geosynchronous orbit while steering the thrust vector both in-plane and out-of-plane while rotating the spacecraft body and steering the solar array to maintain the sun's illumination on the solar array while not maintaining the solar array rotation axis aligned with the orbit normal and while not maintaining an Earth facing panel wherein the thrust vector is not normal to the axis of the solar array and the thrust vector is steered to provide sufficient solar array power to perform maneuvers and minimize propellant usage and/or time to achieve final orbit; and

firing selected ones of the chemical and electric propulsion thrusters to achieve final geosynchronous orbit.

Claim 31 (new): A method for raising a spacecraft launched into a transfer orbit about the Earth from the transfer orbit to a geosynchronous orbit, comprising the steps of:

launching a spacecraft having chemical and electric propulsion thrusters and a solar array;

firing the chemical propulsion thrusters at apogees of intermediate orbits, starting from the transfer orbit initiated by the launch vehicle, to successively raise perigees of the orbit until the spacecraft perigee substantially clears the Van Allen radiation belts, and

where the semi-major axis of the intermediate orbits is substantially less than the semi-major axis of a final orbit, and where the inclination of the intermediate orbits is substantially greater than the inclination of the final orbit;

firing the electric propulsion thrusters to raise the orbit of the spacecraft from the orbit achieved by the chemical propulsion thrusters firing step to near geosynchronous orbit while steering the thrust vector both in-plane and out-of-plane while rotating the spacecraft body and steering the solar array to maintain the sun's illumination on the solar array while not maintaining the solar array rotation axis aligned with the orbit normal and while not maintaining an Earth facing panel wherein a spacecraft steering profile is generated on the Earth that steers the thrust vector (ΔV) such that the thrust vector is not normal to the axis of the solar array and the thrust vector is steered to provide sufficient solar array power to perform maneuvers and minimize propellant usage and/or time to achieve final orbit, and firing selected ones of the chemical and electric propulsion thrusters to achieve final geosynchronous orbit.

Claim 32 (new): A system for raising a spacecraft launched into a transfer orbit about the Earth from the transfer orbit to a geosynchronous orbit, comprising:

a spacecraft comprising chemical and electric propulsion thrusters and a solar array;

a processor onboard the spacecraft wherein the processor generates a spacecraft steering profile onboard the spacecraft that steers a thrust vector (ΔV) to maintain the illumination of the sun's rays substantially normal to solar arrays of the spacecraft and steers the thrust vector (ΔV) such that the thrust vector is not normal to the axis of the solar array and the thrust vector is steered to provide sufficient solar array power to perform maneuvers and minimize propellant usage and/or time to achieve final orbit.

Claim 33 (new): A system for raising a spacecraft launched into a transfer orbit about the Earth from the transfer orbit to a geosynchronous orbit, comprising:

a spacecraft comprising chemical and electric propulsion thrusters and a solar array;

a processor onboard the spacecraft for:

firing the chemical propulsion thrusters at apogees of intermediate orbits, starting from the transfer orbit initiated by the launch vehicle, to successively raise perigees of the orbit until the spacecraft perigee substantially clears the Van Allen radiation belts, and where the semi-major axis of the intermediate orbit is substantially less than the semi-major axis of a final orbit, and where the inclination of the intermediate orbit is substantially greater than the inclination of the final orbit;

firing the electric propulsion thrusters to raise the orbit of the spacecraft from the orbit achieved by the chemical propulsion thrusters firing step to near geosynchronous orbit by steering the thrust vector both in-plane and out-of-plane while rotating the spacecraft body and steering the solar array to maintain the sun's illumination on the solar array, further comprising ground apparatus including a processor that determines a thruster firing profile for firing the thrusters and generates thruster firing commands that implement the thruster firing profile, and communication apparatus that uplinks commands to the spacecraft.